

A Laboratory Guide to the Cat Muscular System

An Honors Thesis (HONR 499)

by

Heather Nawrocki

Thesis Advisor
Dr. Clare Chatot

Signed

Ball State University
Muncie, Indiana

May 2016

Expected Date of Graduation

May 2016

SPC011
Undergrad
Thesis
LD
2489
24
2016
N39

Abstract

Animal dissection plays a vital role in science education, serving as a fundamental teaching tool for anatomy, biology, and zoology courses. Cat dissection, in particular, is used throughout all levels of science education to convey the complex anatomical relationships seen in mammals. Although there are some differences between cat and human anatomy, by dissecting cats, students can gain a greater understanding of human musculoskeletal, organ, circulatory, and nervous systems. Therefore, it is crucial to make sure that dissection manuals are effective and accurate. Alongside Dr. Nawrocki at the University of Indianapolis, I updated an existing departmental laboratory manual, which outlines the step-by-step cat dissection procedure and provides students with a vast array of study materials.

Acknowledgements

I would like to thank Dr. Clare Chatot for advising me not only during this project but also throughout my entire collegiate career. Thanks to her expertise, this project was not so formidable after all.

I would also like to thank Dr. Stephen Nawrocki, my father and supervisor, for without whom neither this project nor I would exist.

Author's Statement

Introduction

To further explore and understand mammalian anatomy, I updated an existing laboratory manual for the upper-level Human Functional Anatomy course (BIOL 305) at the University of Indianapolis with Dr. Stephen P. Nawrocki. Specifically, I was responsible for creating hand-drawn line diagrams of the cat muscular system to simply and quickly illustrate general anatomical relationships. To produce said diagrams, alongside Dr. Nawrocki, I meticulously dissected two preserved cats (one male, one female) provided by UIndy. While doing so, I assisted Dr. Nawrocki in taking high-resolution photographs of the step-by-step dissection procedure and specific muscle groups, some of which were then edited using Adobe Photoshop. Labels and arrows were added using Microsoft Office PowerPoint and the pictures were compiled into a PowerPoint slideshow, which will be distributed to students along with the updated manual in Fall 2016.

By updating the existing manual, we further clarified the detailed aspects of mammalian anatomy. University of Indianapolis anatomy students can now be provided with a variety of visual formats (color photographs, labeled photographs, and black and white line-diagrams showing muscle fiber directions), which will help them to learn fundamental anatomical features and relationships. With this project I was able to review and expand upon my knowledge of mammalian musculoskeletal anatomy to help prepare myself for more rigorous graduate coursework that I will be taking next year as I complete a Master's in Human Biology at UIndy. Developing this teaching tool has not only helped me to prepare for graduate study, but also for medical school, which I hope to enter in the Fall of 2017, and for my future career as a medical doctor.

Dissection

Dissections were conducted in an anatomy laboratory at the University of Indianapolis. To date, I have logged approximately 50 hours dissecting. The cats used for this project were obtained from standard biological supply companies. A variety of dissection techniques were employed throughout the dissection process. For every dissection, cats were placed on dissecting trays and latex gloves were worn. Throughout the process, the cats were sprayed with holding solution, a formalin-free fixative, to inhibit bacterial growth and prevent them from getting too dry. When the cats were not being dissected, they were stored in plastic bags in a secure cabinet in the laboratory. Techniques varied between the two cats due to the fact that one was pre-skinned by the supplier and one was not. Since it is necessary to remove the integument (skin) in order to visualize the cat's bodily systems, the dissection process for the unskinned cat began with removal of the pelt. This process was effected by placing the cat with its ventral (belly) side up. Using a scalpel, a longitudinal incision was made on the cat's left leg above the ankle, through the integument only. Below the integument lies a layer of whitish connective tissue known as "fascia" and below that is the musculature. The incision was lengthened to fully encircle the ankle, and the pelt was slowly peeled off towards the head. In addition to a scalpel, a blunt probe, forceps, and scissors were utilized during skinning. The pelt was removed in sections from each major region of the body by making additional incisions in strategic places, such as at major joints and along the midline. Pelt removal was not conducted around the face and paws because undergraduate students do not typically dissect those areas. Care was taken to avoid damage to any structures or organs other than the skin. However, the cutaneous maximus, a trunk muscle tightly bound to the skin and used to raise the fur, was removed; this muscle is

not normally present in humans. The platysma, another superficial skin muscle in the neck region, was also removed with the skin.

During dissection, it was important to note the major blood vessels and nerves. Veins (the blood vessels that typically carry deoxygenated blood back to the heart) were previously injected with blue latex to make them visible. Arteries (the blood vessels that typically carry oxygenated blood throughout the body) had been injected with red latex. Very small cutaneous (to the skin) blood vessels were either torn or cut whilst removing the pelt. Subcutaneous veins (veins that lie in the fascia layer between the integument and the body wall) such as the external jugular veins are much larger than the easily removable cutaneous blood vessels; the former were visible after removing the pelt. While large subcutaneous veins can be seen, the same cannot be said for subcutaneous arteries. Arteries have higher pressure than veins and if damaged would bleed profusely, therefore arteries are protected by keeping them deep. The large subcutaneous veins are used for heat dissipation. In addition to blood vessels, nerves (whitish fibers that transmit sensation impulses) were also seen coursing throughout the fascia in a segmental pattern. Tiny cutaneous nerves were typically cut and removed during dissection, but larger motor nerves (such as the long thoracic nerve on the serratus anterior muscle) were left in place. In my rather superficial dissections, the large nerve plexuses (where many nerves intersect and merge before heading to the limbs) were left in place for later examination. For instance, divisions of the brachial plexus could be seen below the pectoralis muscles, but they were not yet clarified or removed.

After both cats were sufficiently skinned, I began the meticulous process of removing fat and fascia. Fat stores are commonly seen lying between different muscles and organs. Fat insulates, protects, and stores energy for the body. Fascia encompasses and separates most

muscles and once removed, distinctions could be made between muscles, and their origins, insertions, and boundaries could be definitively mapped. Fat and fascia thickness varied in different areas of the body and between the two cats. Thin, superficial layers of fascia were easily removed, however, some tougher, deeper sheets of fascia were not removed. Specifically, the lumbodorsal fascia (actually a sheet-like muscle tendon, or *aponeurosis*) is the origin of the latissimus dorsi in the lumbar (lower) region of the back. Additionally, the aponeuroses of the oblique muscles (the “rectus sheath”) was left in place.

While cleaning, I noticed that the two cats were slightly different. While differences in size and particular muscle development were expected between the two cats, I did not expect to see differences in overall muscle condition. The previously-skinned cat’s muscles were in much better condition since its skinning took place before it was fixed (embalmed) with formalin. Its muscles were significantly easier to clean and had a pinkish hue. However, formalin fixation of the unskinned cat was completed *before* it was skinned, and its muscles were slightly more brittle and less pink. The subcutaneous fascia in the cat with the pelt was harder and more difficult to remove due to embalming, and removing that fascia invariably damaged the muscles; in the skinned cat, much of the superficial fascia overlying the muscles had come off with the skin prior to embalming, so less work was needed to clean the muscles, resulting in much less damage. Therefore, purchasing pre-skinned cats not only saves students time in the lab but actually produces *better dissections*.

Overall, cleaning both cats (removing superficial fat and fascia) took up the majority of my time in the laboratory. Scrupulous cleaning was imperative. Muscle boundaries need to be unambiguous so that they can be clearly identified in the photos by students. Thoroughly-cleaned

muscles photographed much better and therefore could more adequately demonstrate anatomical relationships.

Dissection, or separation, employed a variety of techniques. Predominantly, a scalpel was used to separate the muscles along visible cleavage lines, which became more apparent after cleaning. Fiber direction was studied in muscles that were not easily discernable from one another. Skeletal muscles (the only type of muscle seen up to this point in dissection) are made up of units or bundles of muscle fibers (cells). Typically, fibers form very distinct striations in muscles that can be seen in gross dissection and which help students to understand their direction of pull when they contract. A muscle may be given a name based the directionality of its striations. For instance, the external abdominal oblique muscles have oblique striations, ones that run neither parallel with or at a right angle to the midline. Every muscle will have its own uniform fiber pattern. Therefore, when a muscle's boundary was somewhat difficult to determine, differences in fiber direction indicated different muscles, which could then be separated. Additionally, to separate muscles, I commonly pulled them apart using forceps and the back-side of a scalpel to ensure that I didn't accidentally make undesired cuts. To make some muscle boundaries more distinguishable, artificial edges were cut (such as for the long, ragged lateral edge of the latissimus dorsi). At this point in the dissection, most deep muscles have not been analyzed.

Dissection proved to be a valuable tool not only for the sake of this manual, but for me as well. Being able to comprehensively dissect a cat under the direction of a professional anatomist gave me the opportunity to learn proper techniques, make observations, and ask questions. For instance, whilst dissecting, I noticed many similarities and differences between the skeletal muscles of cats and humans. Perhaps the biggest factor behind the differences seen between cats

and humans is the fact that cats are quadrupeds (use four legs to walk) while humans are bipeds (use two legs to walk). Because cats are quadrupeds, their belly faces the ground when they move. To keep their thorax from inadvertently hitting the ground, cats have muscles that function slightly different than they do in humans. The serratus anterior (a muscle also present in humans) has more of a stabilizing function in cats to elevate the thorax between the scapulae, which are fixed when the forepaws are on the ground. Humans walk with their bellies perpendicular to the ground and their hands are free rather than weight-bearing, and therefore the serratus anterior is free to serve as a mover of the scapula on the thorax. In other words, the relative origin and insertion of the serratus is reversed in humans compared to cats, even though the muscle attaches to the same bony points in both species. In addition to the orientation difference between a cat and a human thorax, a cat thorax is also longer and deeper from front to back. Cats have more thoracic vertebrae than humans and consequentially more ribs. The abdomen is similarly elongated, with more lumbar vertebrae than in humans. The elongated trunk as a whole increases spinal flexibility and mobility during locomotion.

Because cats have a proportionally longer trunk, their trunk musculature appears different from humans. The rectus abdominus and scalene muscles are both longer in cats to support their lengthier trunk. Another muscle group that is more developed in cats is the pectoralis group. Humans have two muscles that make up their pectoralis group whereas cats have four. In addition to the pectoralis major and the pectoralis minor, the xiphihumeralis (caudal and deep to the pectoralis minor) and the pectoantebrachialis (cranial and superficial to the pectoralis major) are present in cats. These extra two muscles have regressed and fused to the rest of the pectoralis muscle group in humans. Muscles were originally named for their location and function in humans, which is why in humans the pectoralis major refers to the bigger of the

two pectoralis muscles and the pectoralis minor refers to the smaller of the two. However, in cats the pectoralis minor is actually bigger than the pectoralis major. The pectoralis minor is bigger in cats for extension of the brachium (upper arm) during running, a movement that is trivial in humans, seeing as we do not run with our brachium. The pectoralis major in cats functions primarily as a horizontal flexor of the brachium (bringing the upper arm across the chest). Additionally, some of the pectoralis muscles cross the elbow to reach the antebrachium (forearm) in cats, increasing the webbing along the entire forelimb. For instance, the pectoantebrachialis extends from the midline to the antebrachium. Humans, on the other hand, have no muscles that go from the trunk to the forearm, for freedom to extend the arm above the head whilst climbing, a movement utilized by primates (the scientific order humans belong to; cats are carnivorans).

Overall, dissecting reinforced my knowledge of human anatomy, which will come in handy next year as I take classes at the graduate level and in medical school. While we completed dissection of the superficial cat musculature this past semester, the dissection process will continue throughout the summer. We will dissect deep muscles of the neck, thorax, abdomen, back, and limb by cutting superficial muscles and reflecting them. We will also study other bodily systems like the circulatory, nervous, organ systems.

Photographs

Once certain muscle groups were sufficiently cleaned and dissected, they were photographed. I assisted Dr. Nawrocki in taking high-resolution photographs mainly by maneuvering the cats and holding them steady while he photographed them. We decided that a yellow-colored background provided the best contrast. So far, we have taken over five hundred photographs. After photographs were taken, the best were then edited using Adobe Photoshop.

Photographs were cropped, rotated, adjusted for contrast and brightness, and sharpened.

Photoshop smudge, clone, blur, and magic eraser tools were used to remove unnecessary items from the background like shadows and stray hairs. Photographs were also compressed so that they could be opened in PowerPoint.

After photographs were sufficiently edited, they were copied to corresponding Microsoft PowerPoint slides. To express different noteworthy features, the same photograph is presented throughout multiple slides. For each muscle group, the first slide contains an unlabeled photograph, which serves to orient and quiz students. The second slide contains a labeled photograph with blue arrows pointing to central parts of the photograph and either black or white numbers situated on less important but still relevant features. A third slide was usually included to outline fiber directions and boundaries of muscles that overlap. When the PowerPoint is in normal view, as opposed to slideshow view, students can also read the notes section of each slide, which contains a description/key.

Additional photographs will be taken as new muscle groups and bodily systems are dissected. They will also be edited and placed in corresponding PowerPoint slides.

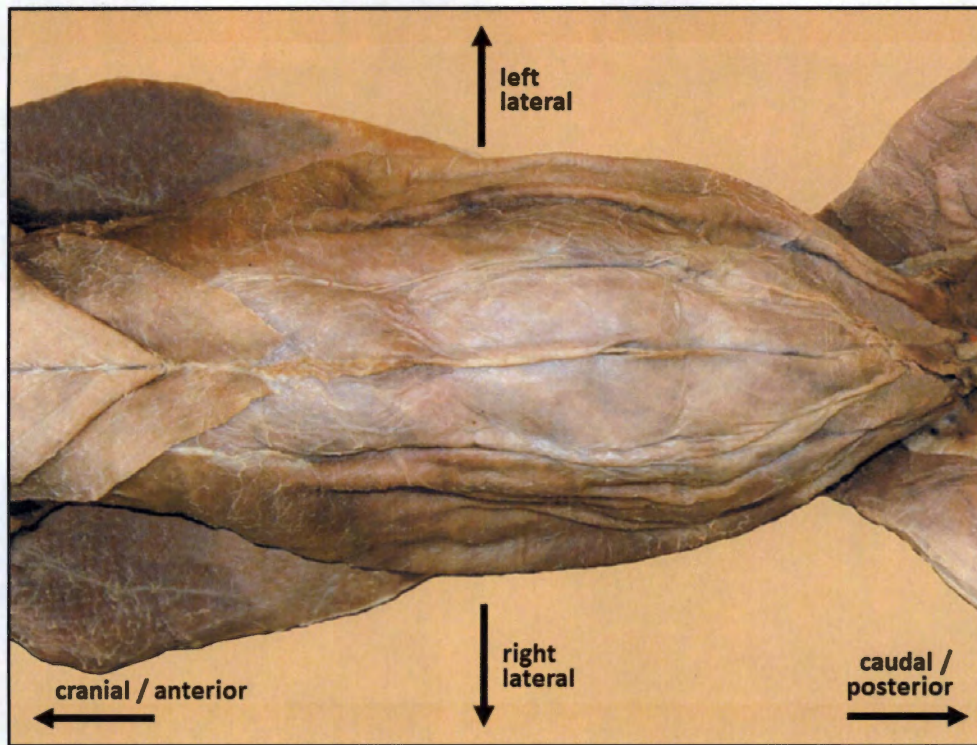
Drawings

One of the main reasons why Dr. Nawrocki wanted to make a new cat dissection manual was to include non-copyrighted illustrations, ones that could demonstrate anatomical relationships as he saw fit. Therefore, after we chose the best photographs, it was my responsibility to convert them into black and white line-diagrams. This process took many months, and as of now, I have produced the following drawings: ventral view of the chest (superficial), ventral view of the throat (superficial), lateral view of the right side of the chest

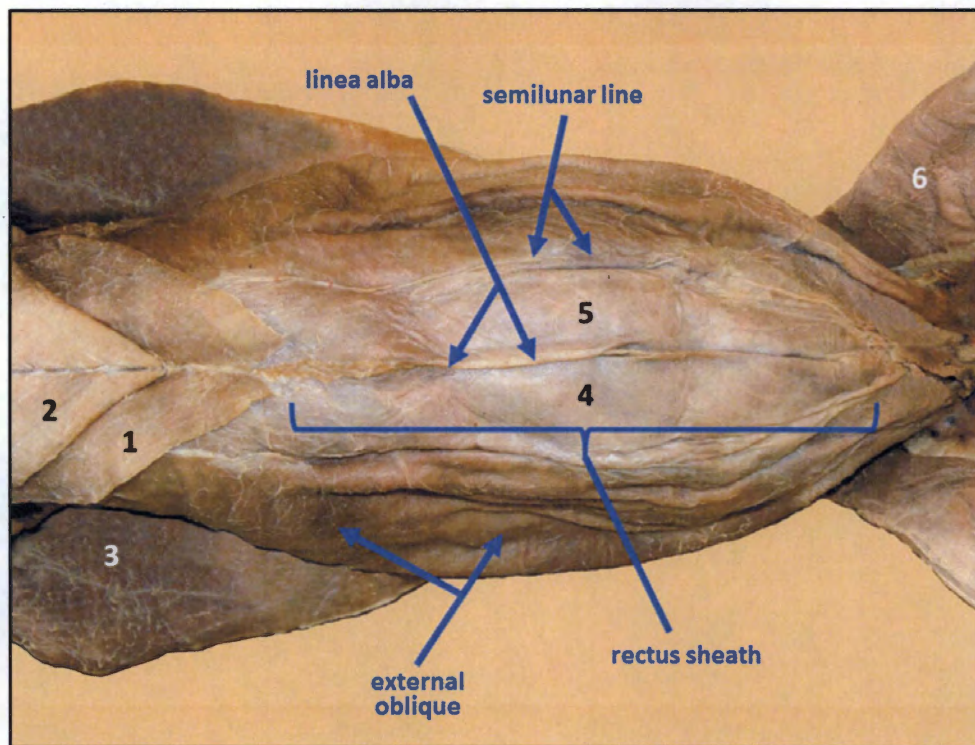
(superficial), lateral view of the left shoulder (superficial), and lateral view of the left hip (superficial). By looking at our photographs and at illustrations included in previously-published dissection manuals, I produced these five drawings. The most difficult part of the process was creating drawings that adequately represented the photographs. Turning a 3D object into a 2D illustration is always challenging. Sometimes I drew four or five drafts before I produced my final drawing. Through trial and error I found which drawing techniques worked best. For instance, discovering the best way to convey fiber direction took a long a time -- a pencil can only make lines so small. Bilateral drawings (such as the ventral view of the chest) in which symmetry was key were somewhat harder to produce compared to lateral views. Typically, for bilateral images I would draw one side and then trace and reflect it to draw the other side. I used this technique to draw the ventral view of the throat. The ventral views of the left shoulder and of the left hip, while time-consuming, were some of the easiest photographs to draw because I only had to draw one side of the body. Our main concern was to produce drawings that could be directly compared to the photographs, with the same proportions and outlines. To do this, drawings like the ventral view of the chest turned out to be less symmetrical than one might assume, but the goal was to keep them lifelike, so I did just that. Muscles are not always perfectly symmetrical, especially after being preserved for so long.

I produced said drawings in an 11x14 inch sketchbook then scanned them onto the computer. I will be responsible for producing additional illustrations as we dissect and photograph additional parts of the cat this summer. In the final manual, my drawings will be printed next to their corresponding photographs for side-by-side comparison. Giving students multiple ways to study will hopefully make the material easier to understand.

For my Honors Project, I included scans of my original drawings, so that I may continue to edit them as Dr. Nawrocki sees fit. Additionally, I have placed my drawings next to the photographs in which they were modeled after for direct comparison. The PowerPoint slide show is on the attached flash drive since the goal is for students to view it on their computers, so for the full effect, I recommend seeing it this way. However, I have also included a paper version of the slide show for quick viewing. Additional photographs of the dissection process have also been included.

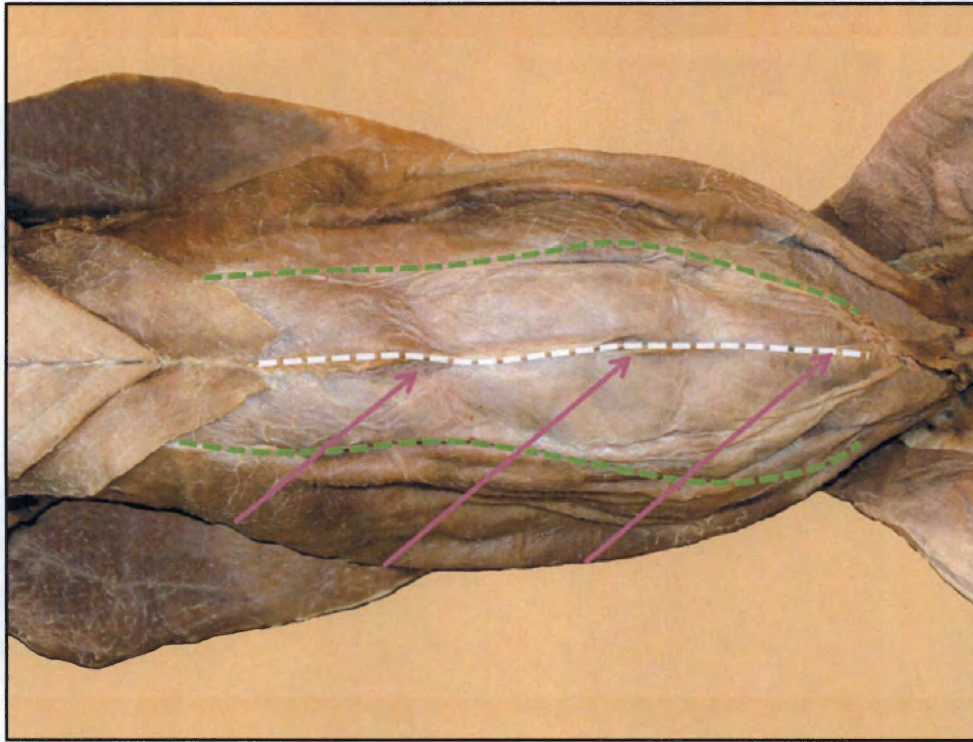


Ventral view of the abdomen, superficial dissection (orientation). The integument and subcutaneous fascia has been removed, revealing the muscles of the abdominal wall below.



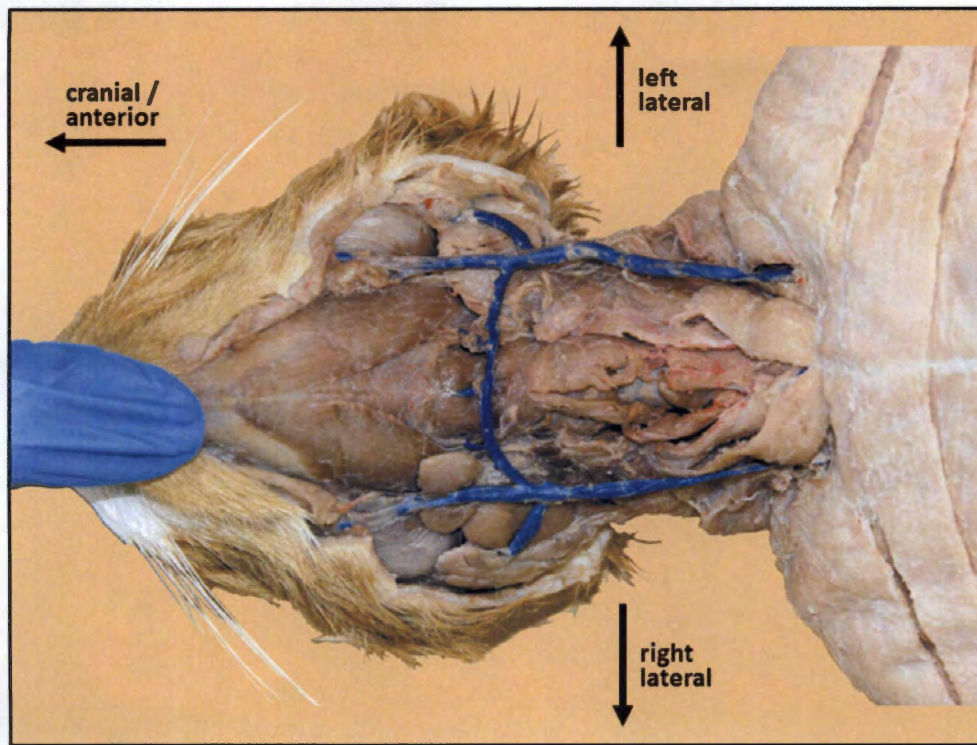
Ventral view of the abdomen, superficial dissection (labeled). Primary muscles for this view are indicated by blue arrows. Other muscles and structures are numbered:

- (1) xiphihumeralis
- (2) pectoralis minor
- (3) latissimus dorsi
- (4) right rectus abdominis muscle (deep to the sheath)
- (5) left rectus abdominis muscle (deep to the sheath)
- (6) sartorius

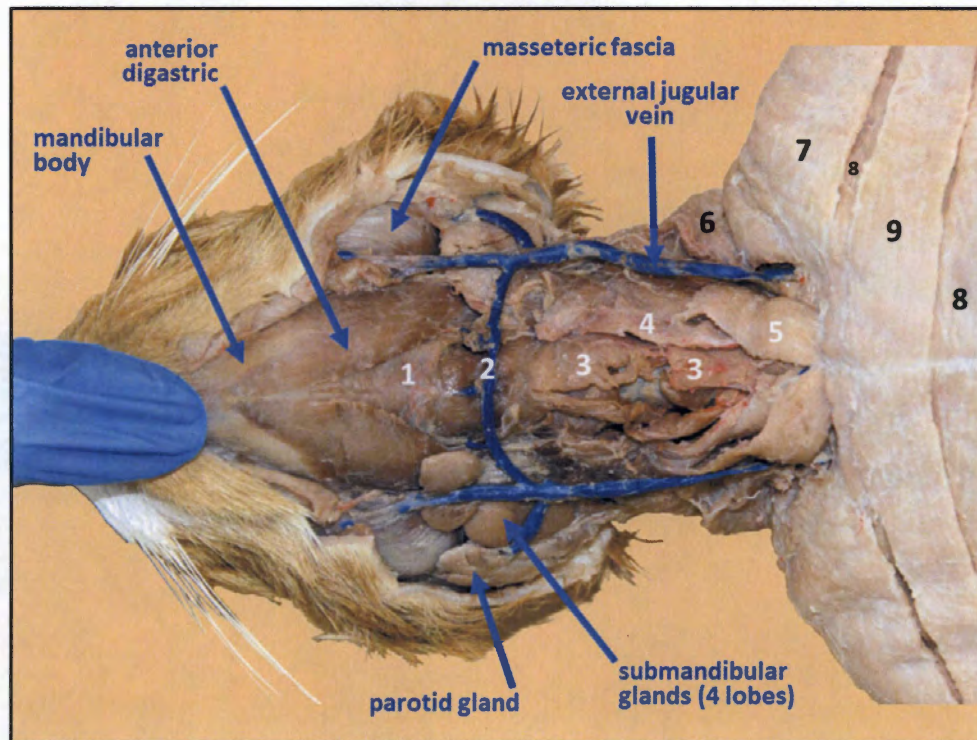


Ventral view of the abdomen, superficial dissection. Did you notice?

- (1) The rectus sheath is comprised of the fused flattened tendons or **aponeuroses** of the 3 abdominal oblique muscles. In this superficial view, the visible fibers of the sheath belong primarily to the external obliques. The point where the external oblique muscle fibers turn into tendon (collagen) fibers is known as the **semilunar line** (marked by the green dashed lines); the rectus sheath therefore lies between the semilunar lines.
- (2) While difficult to see in this photo, the fiber directions of the external oblique and its aponeurosis run **caudally** and **medially** (following the pink arrows).
- (3) Where the aponeurosis fibers meet in the midline, they knit together to form a **raphé** instead of inserting into bone. The raphé formed here on the front of the abdomen is also called the **linea alba** ("white line"); it falls between the left and right halves of the rectus sheath.
- (4) The pectoralis muscles lay *on top of* (superficial to) the abdominal muscles; note how the external oblique and the rectus sheath extend below the xiphohumeralis.

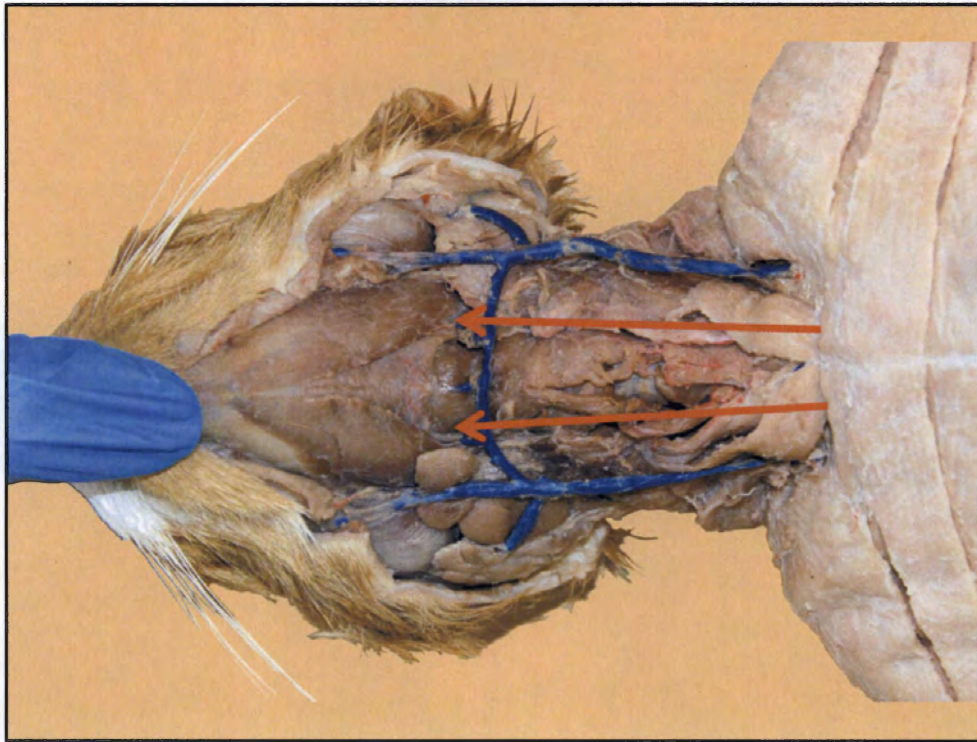


Ventral view of the throat, superficial dissection (orientation). The integument and subcutaneous fascia has been removed, revealing the muscles, veins, and glands of the throat.



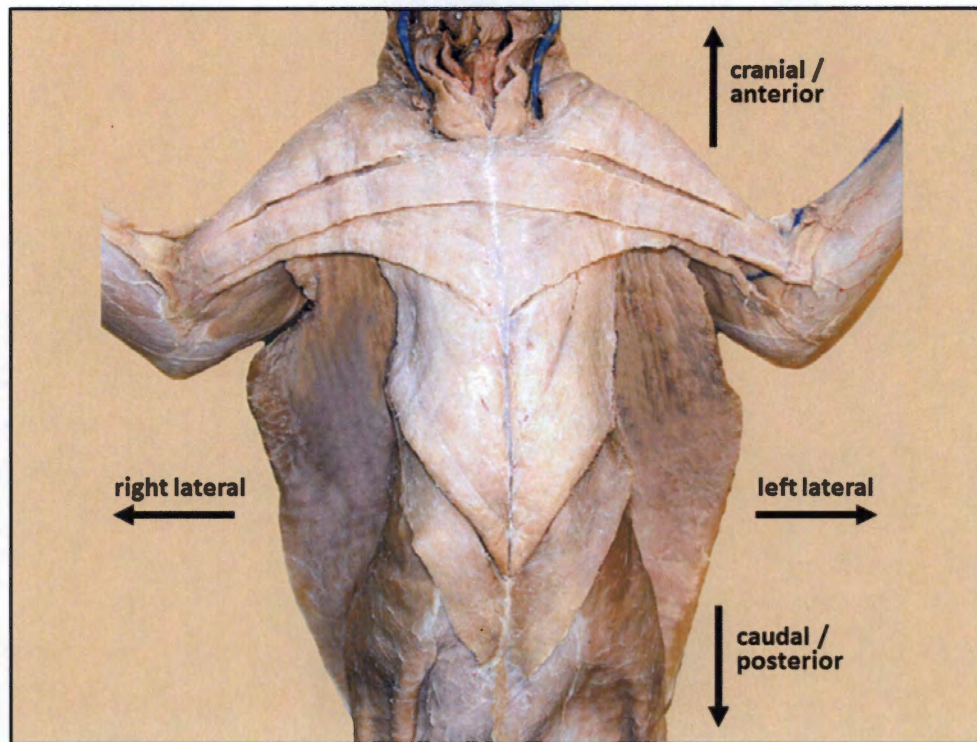
Ventral view of the throat, superficial dissection (labeled). Primary muscles for this view are indicated by blue arrows. Other muscles and structures are numbered:

1. mylohyoid
2. transverse facial vein
3. sternohyoid (damaged by embalming)
4. sternothyroid
5. sternomastoid
6. anterior trapezius
7. anterior deltoid
8. pectoralis major
9. pectoantebrachialis

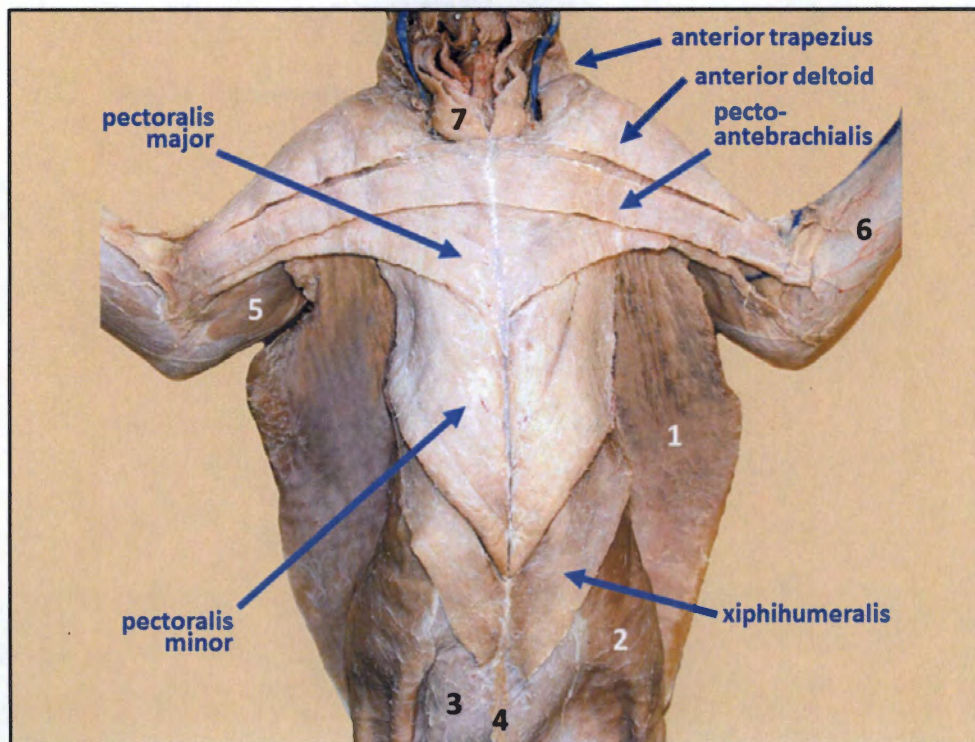


Ventral view of the throat, superficial dissection. Did you notice?

- (1) Large subcutaneous veins lie superficial to the muscles; these veins drain deoxygenated blood from the surrounding tissues and integument and are important for temperature regulation. Note that there are no correspondingly-large arteries below the skin; the higher-pressure arteries would bleed profusely if damaged.
- (2) The muscles of the throat are generally thin and strap-like, running cranially from the vicinity of the sternum (red arrows). They are frequently torn when the supply company fishes for the carotid arteries during the embalming process. Better images of the of these muscles are provided later.

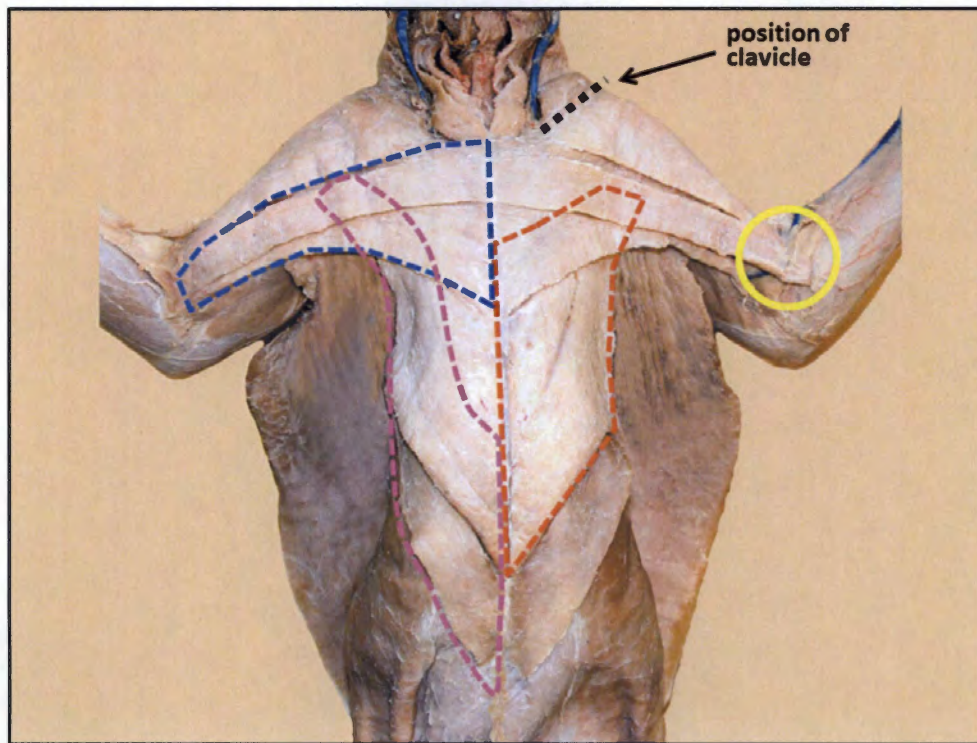


Ventral view of the chest, superficial dissection (orientation). The integument and subcutaneous fascia has been removed, revealing the muscles of the ventral thorax.



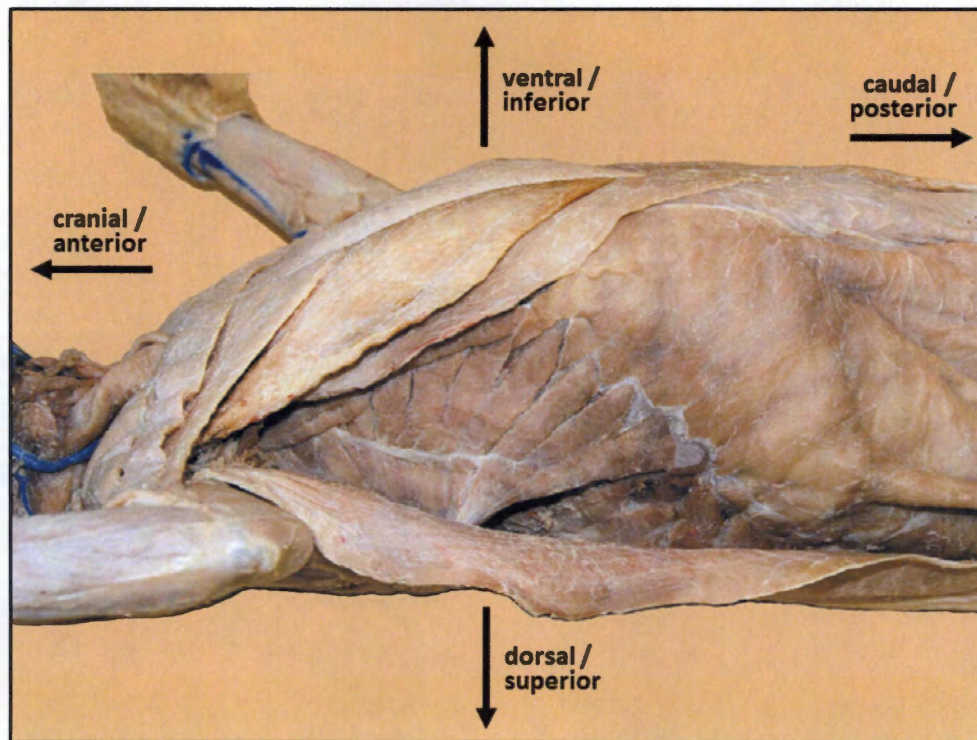
Ventral view of the chest, superficial dissection (labeled). Primary muscles for this view are indicated by blue arrows. Other muscles and structures are numbered:

- (1) latissimus dorsi
- (2) external oblique
- (3) rectus sheath
- (4) linea alba
- (5) epitrochlearis
- (6) fascia of forearm (forearm / wrist flexor muscles are hidden below)
- (7) sternomastoid

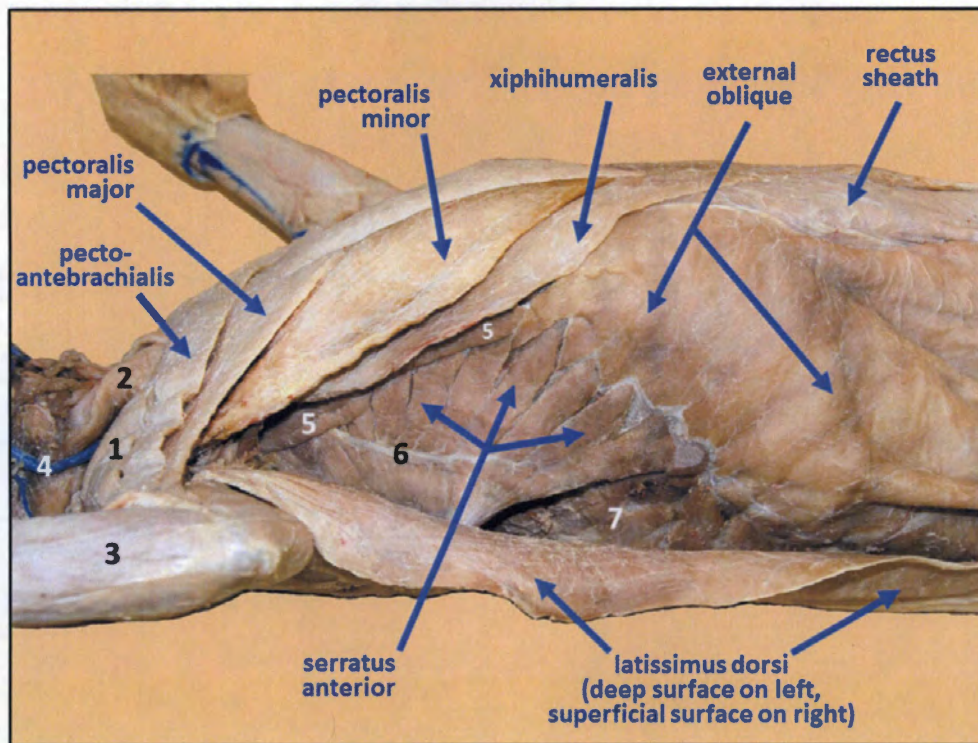


Ventral view of the chest, superficial dissection. Did you notice?

- (1) Many muscles that move the forelimb originate on the trunk; all of these muscles are *superficial to* (and therefore cover) the trunk muscles (intercostals, obliques, erector spinae, etc.).
- (2) The pectoralis muscles of the cat are more complex than those of humans; cats have 4 on each side, humans have 2.
- (3) The cat's pectoralis minor (dashed red outline) is larger than the pectoralis major (dashed blue outline); the sizes are reversed in humans, for whom the muscles were originally named.
- (4) You can see the the larger pectoralis minor extending out from below the smaller major and down across the elongated thorax; the major is partially hidden deep to the pectoantebrachialis and the anterior deltoid (clavobrachialis).
- (5) The xiphihumeralis (dashed pink line) extends cranially, deep to the pectoralis minor.
- (6) Some of the cat's pectoralis muscles extend all the way to the forearm (yellow circle), creating webbing between the trunk and the upper extremity that would be disadvantageous in humans because it would limit free motion of the limb above the head (a primate hallmark!).
- (7) The approximate position of the small clavicle is illustrated with the dashed black line; it floats in the musculature and cannot be seen on the surface (although you should be able to palpate it). The anterior trapezius inserts into the clavicle's cranial edge, while the anterior deltoid originates from the clavicle's caudal edge .

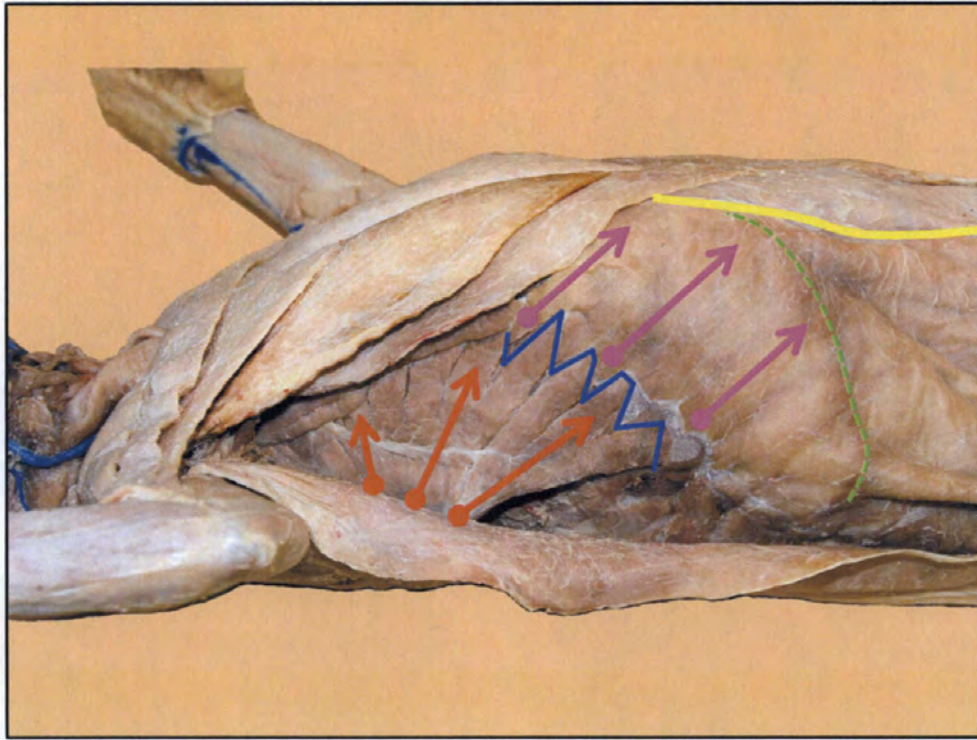


Lateral view of the right side of the chest, superficial dissection (orientation). The integument and subcutaneous fascia has been removed, revealing the muscles on the lateral side of the trunk. The latissimus has been pulled away partially from the trunk to reveal the muscles deep to it.



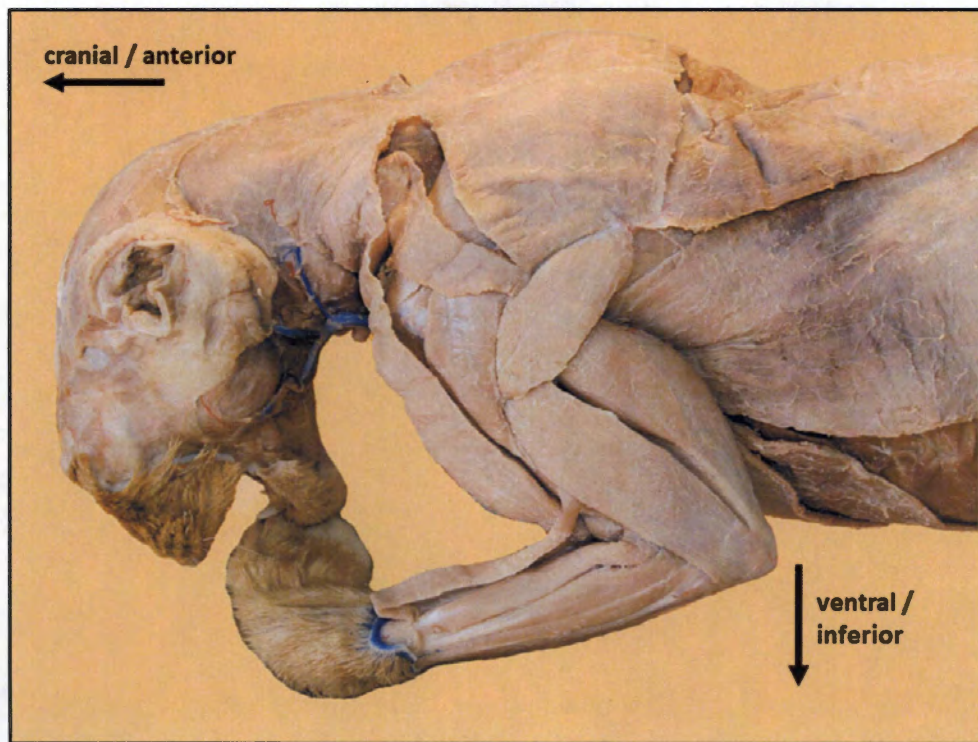
Lateral view of the right side of the chest, superficial dissection (labeled). Primary muscles for this view are indicated by blue arrows. Other muscles and structures are numbered:

- (1) anterior deltoid
- (2) sternomastiod
- (3) forearm fascia
- (4) external jugular vein
- (5) scalene muscles
- (6) long thoracic nerve (on surface of serratus anterior)
- (7) serratus posterior

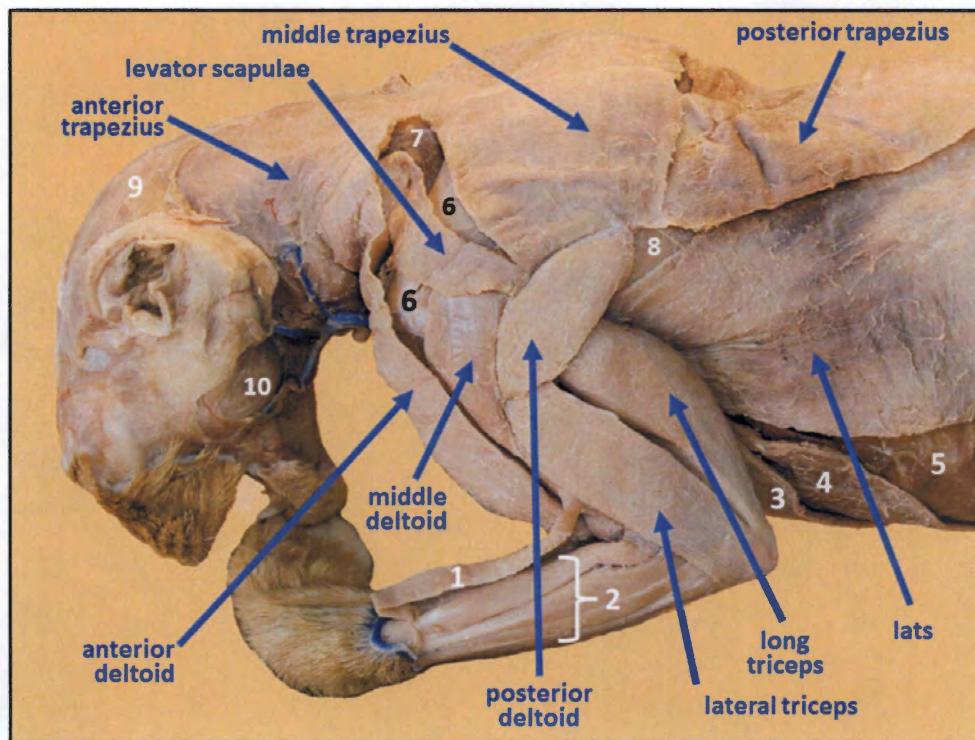


Lateral view of the right side of the chest, superficial dissection. Did you notice?

- (1) The origin of the serratus anterior on the medial border of the scapula (red dots) is hidden by the latissimus in this view; note how the fibers of serratus fan out across the chest (red arrows) to insert in separate bundles into the ribs.
- (2) The insertion of the serratus anterior and the origin of the external oblique interdigitate (blue line).
- (3) The origin of the external oblique is on the external surfaces of the ribs (pink dots); the fibers extend caudally and medially across the thorax and abdomen and end at the semilunar line (yellow line).
- (4) Note that the pectoralis muscles cover (are superficial to) the cranial portions of the external oblique; the external oblique in turn covers part of the thorax and the intercostal muscles (the dashed green line marks the caudal edge of the ribcage).

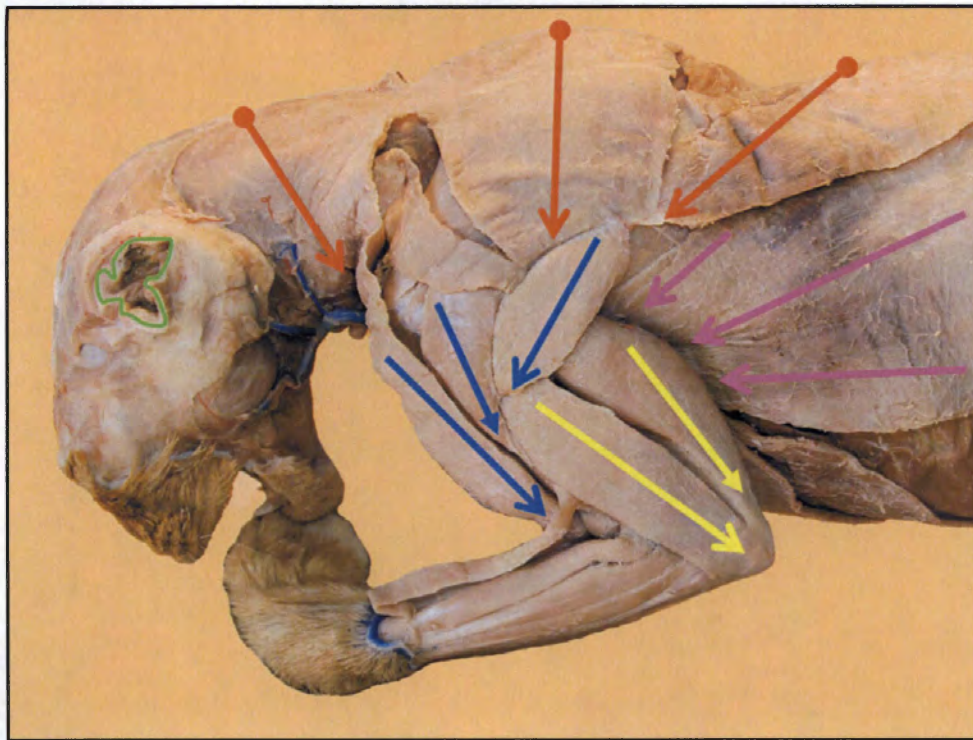


Lateral view of the left shoulder, superficial dissection (orientation). The integument and subcutaneous fascia has been removed, revealing the muscles of the shoulder, brachium, and forearm. Note that the distal end of the brachioradialis has been folded to take up the slack when the elbow is flexed. Also note that the majority of the external ear (the *pinna*) has been cut off, and the whitish cartilage that gives it stability is visible.



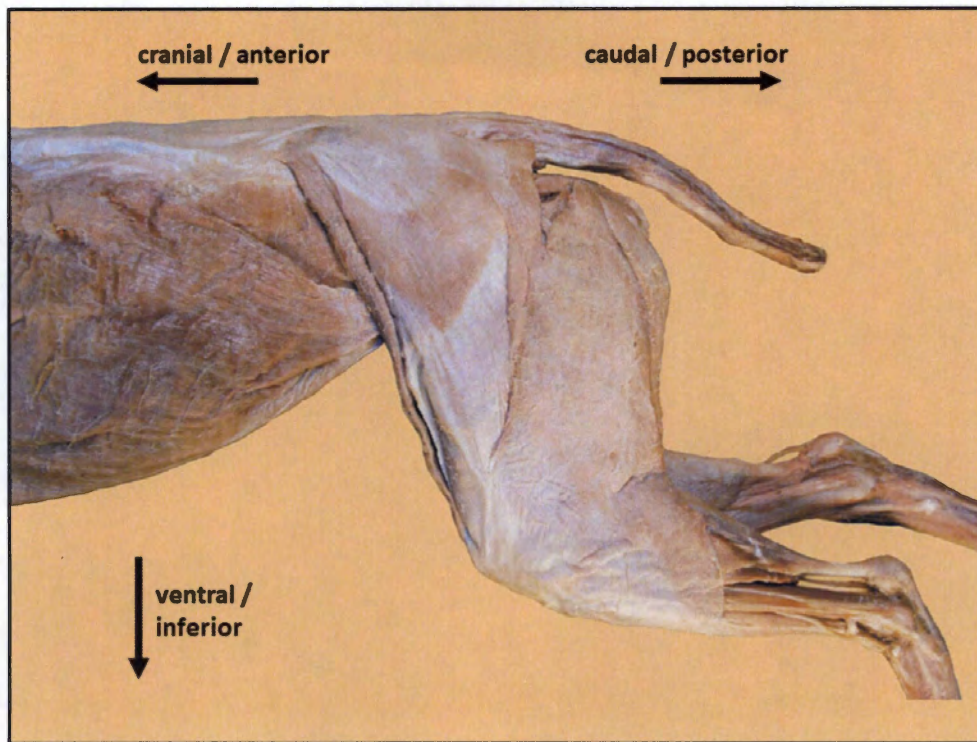
Lateral view of the left shoulder, superficial dissection (labeled). Primary muscles for this view are indicated by blue arrows. Other muscles and structures are numbered:

- (1) brachioradialis
- (2) forearm / wrist extensor muscles
- (3) pectoralis minor
- (4) xiphohumeralis
- (5) external oblique
- (6) supraspinatus (covered by traps & levator)
- (7) nuchal muscles (not distinguishable yet)
- (8) infraspinatus (covered by lats & traps)
- (9) occipitofrontalis
- (10) masseter

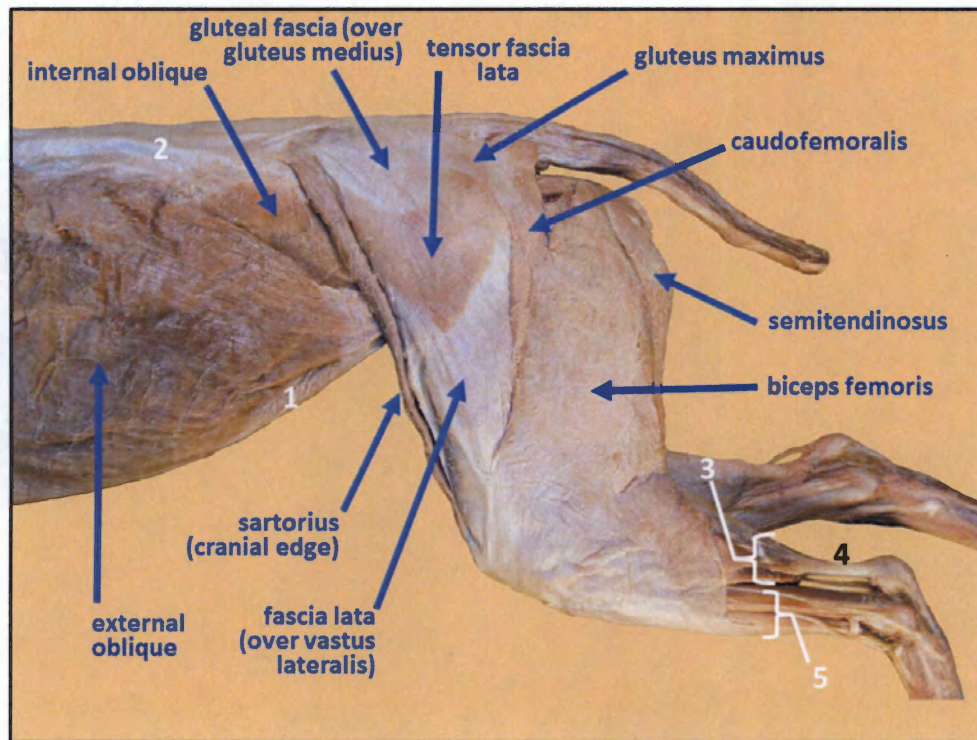


Lateral view of the left shoulder, superficial dissection. Did you notice ...?

- (1) The trapezius is subdivided into 3 segments (anterior, middle, & posterior). They originate along the midline of the back and neck (red circles) and converge towards the shoulder, so the fiber directions in each segment are slightly different (red arrows). In humans, the 3 segments converge into a single sheet of muscle, but the fiber directions are the same.
- (2) Similarly, the deltoid is subdivided into 3 segments (anterior, middle, & posterior) that run from the pectoral girdle towards the humerus (blue arrows). In humans, the 3 segments converge into a single sheet of muscle, but the fiber directions are the same. Note that the anterior segment is much longer than the others and reaches the forearm; in humans, the anterior deltoid is shorter and inserts higher up on the humeral shaft with the other 2 segments.
- (3) The fibers of the latissimus dorsi (pink arrows) are converging to insert on the humeral shaft.
- (4) Two of the 3 segments of the triceps (the **lateral** and **long** heads, yellow arrows) are visible as they converge to insert on the elbow.
- (5) The cartilage of the ear that has been cut is outlined in green.

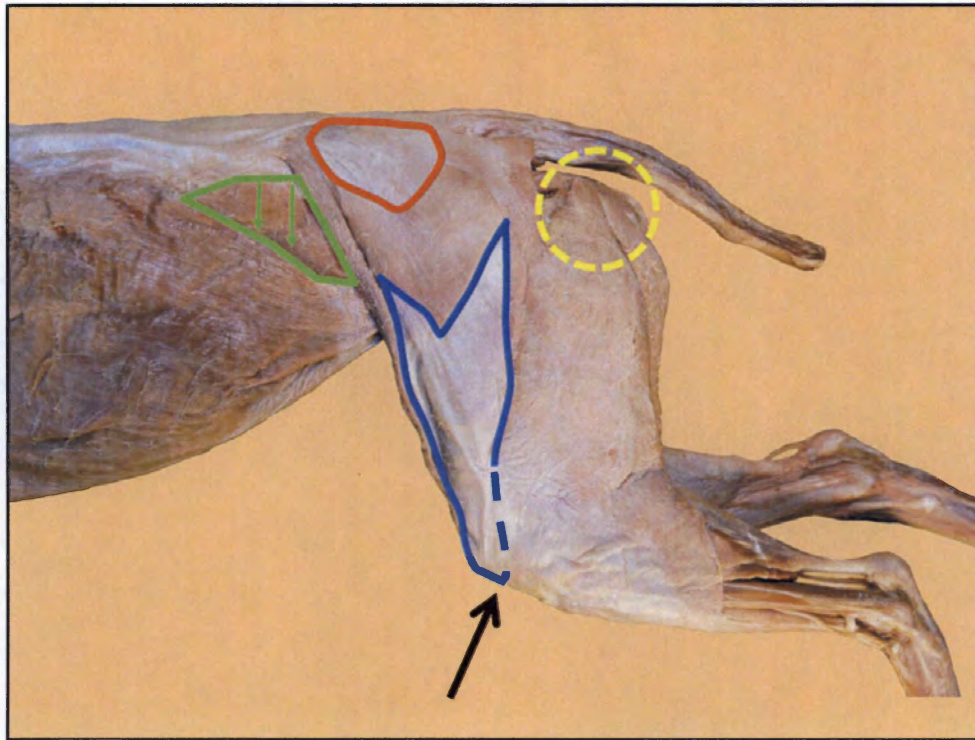


Lateral view of the left hip, superficial dissection (orientation). The integument and subcutaneous fascia has been removed, revealing the muscles of the lower abdomen, tail, hip, thigh, and leg.



Lateral view of the left hip, superficial dissection (labeled). Primary muscles for this view are indicated by blue arrows. Other muscles and structures are numbered:

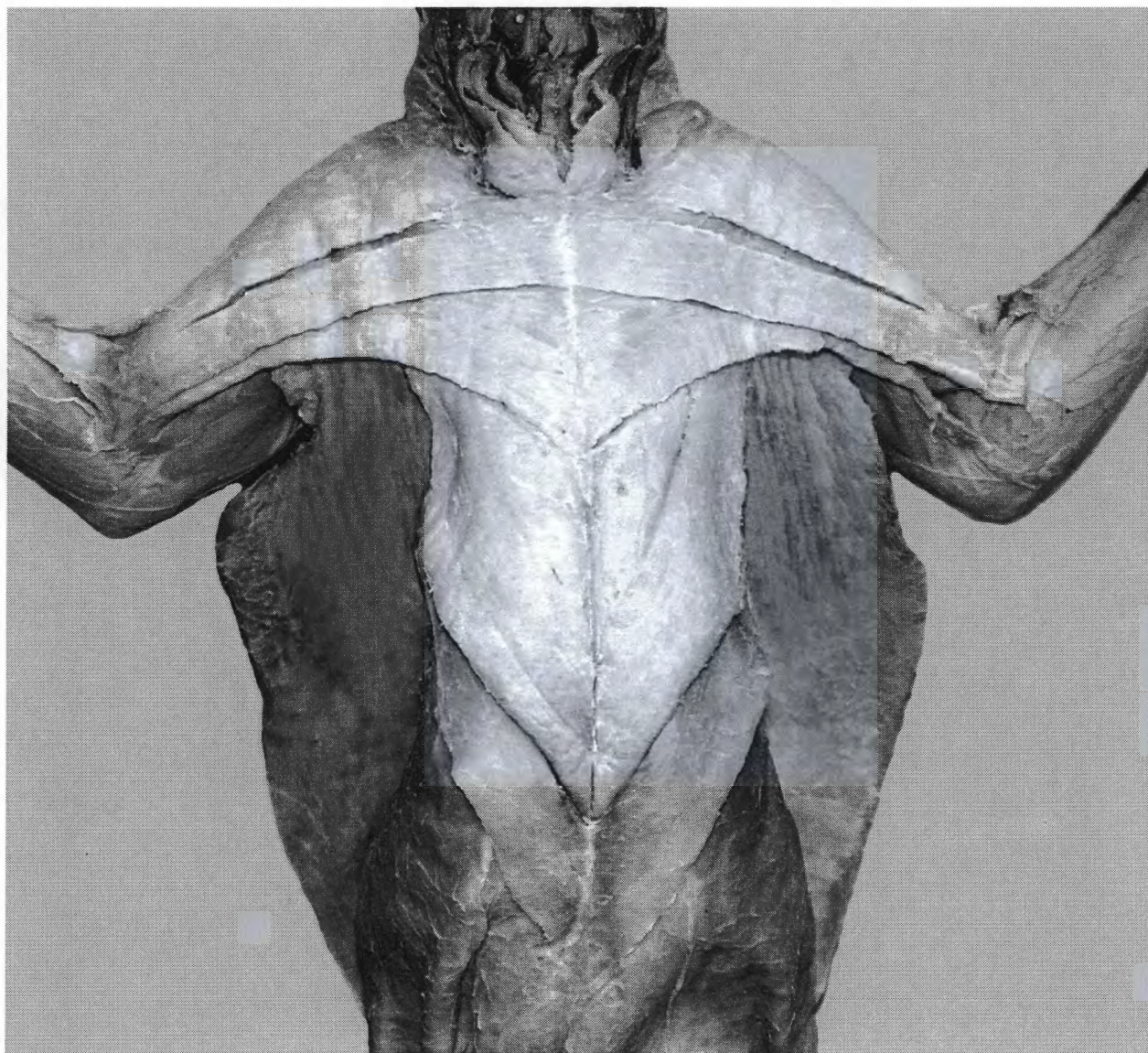
- (1) rectus sheath
- (2) lumbar fascia
- (3) plantarflexors of the ankle (soleus, gastrocnemius)
- (4) Achilles tendon
- (5) other leg muscles that cross the ankle (peroneals, etc.)



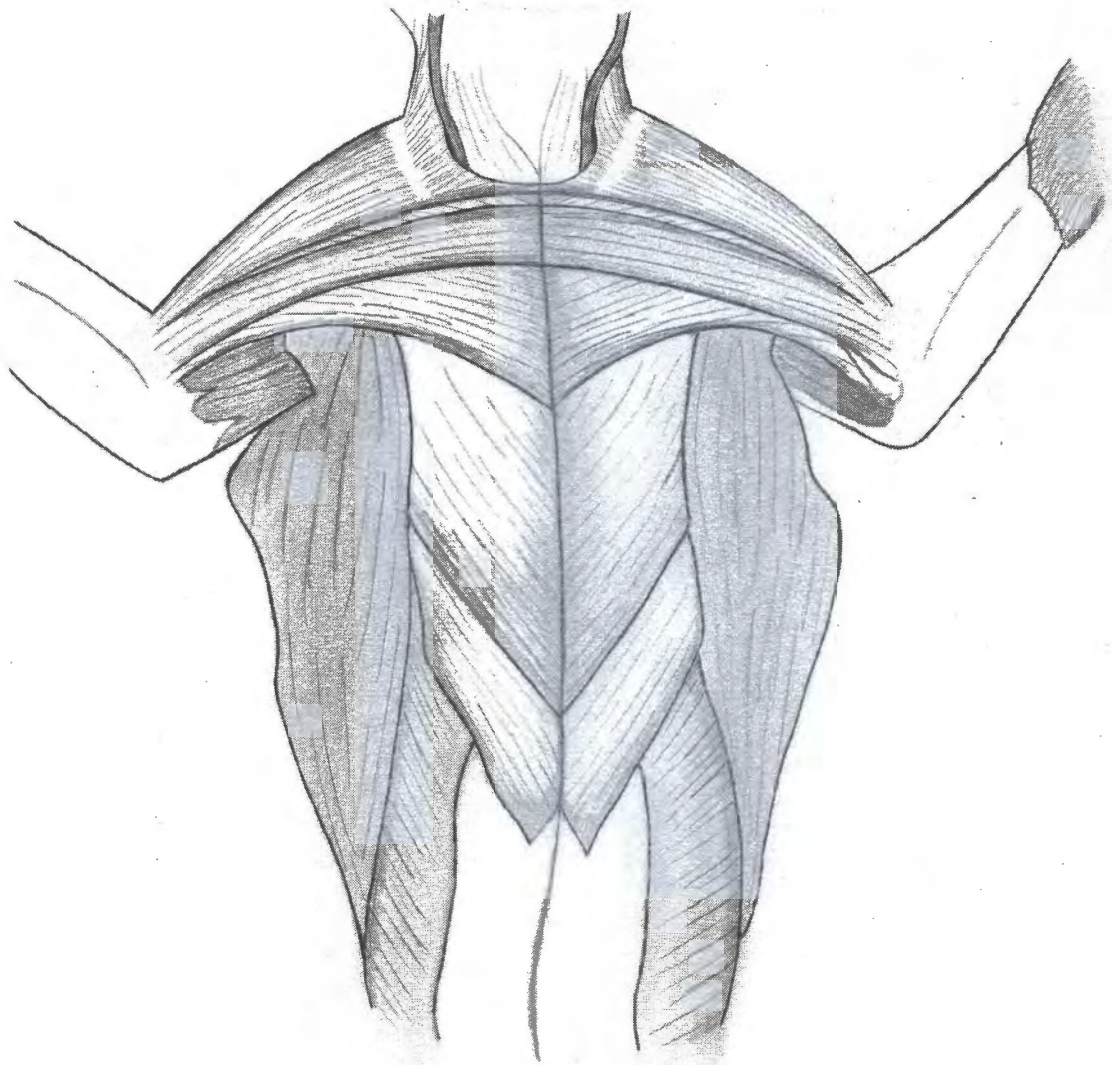
Lateral view of the left hip, superficial dissection. Did you notice ...?

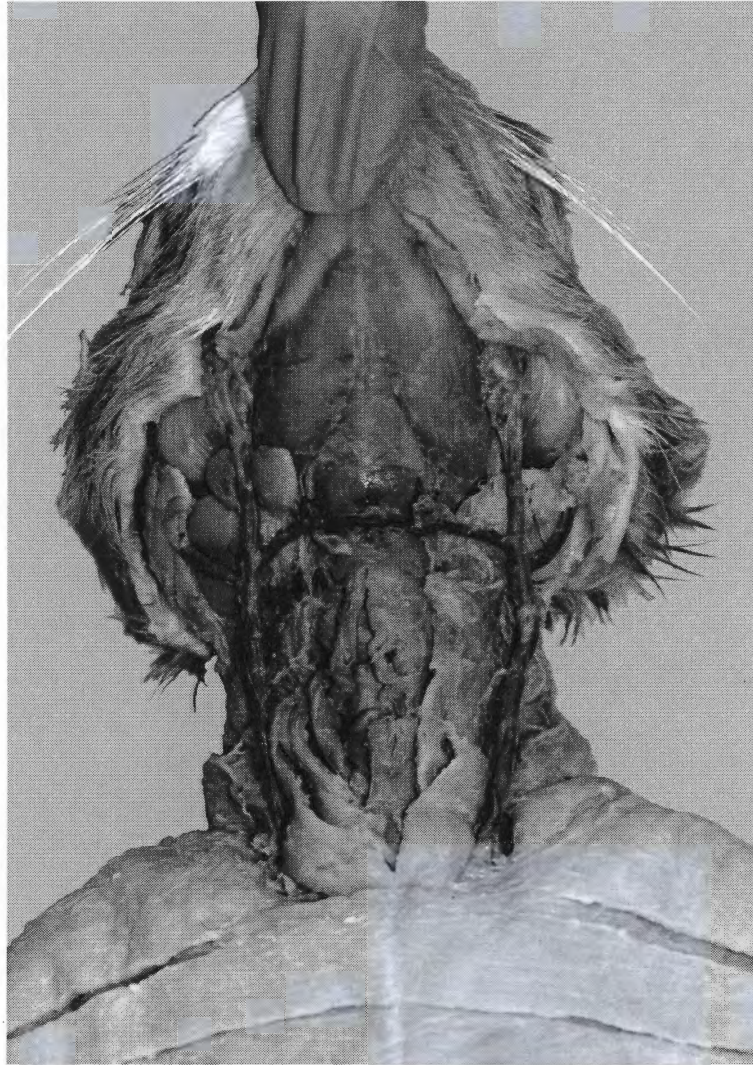
- (1) Because the oblique muscles have slightly different origins, insertions, and positions, the internal oblique is visible deep and dorsal to the external oblique (green outline). You can see the internal originating from the lumbar fascia in this position. The fibers of the external are visible; note that the the fibers of the internal run in a different direction (green arrows).
- (2) The gluteus medius and full extent of the gluteus maximus are not yet visible and will be shown in a later photo. The gluteal fascia (red outline) serves as an origin point for both the tensor fascia lata and gluteus maximus. The tensor is much wider than in humans; note how it will pull on (tense) the fascia lata.
- (3) The fascia lata (blue outline) covers (invests) much of the lateral and anterior thigh. The fascia blends with the tendon of insertion of the biceps femoris (blue dotted line).
- (4) Only the cranial edge of the sartorius is visible; the majority of it will be seen in a medial view of the thigh.
- (5) The 3 hamstring muscles originate from the ischial tuberosity, the position of which is in the yellow circle.
- (6) The approximate position of the patella is indicated by the black arrow.

Drawings (with corresponding photographs)

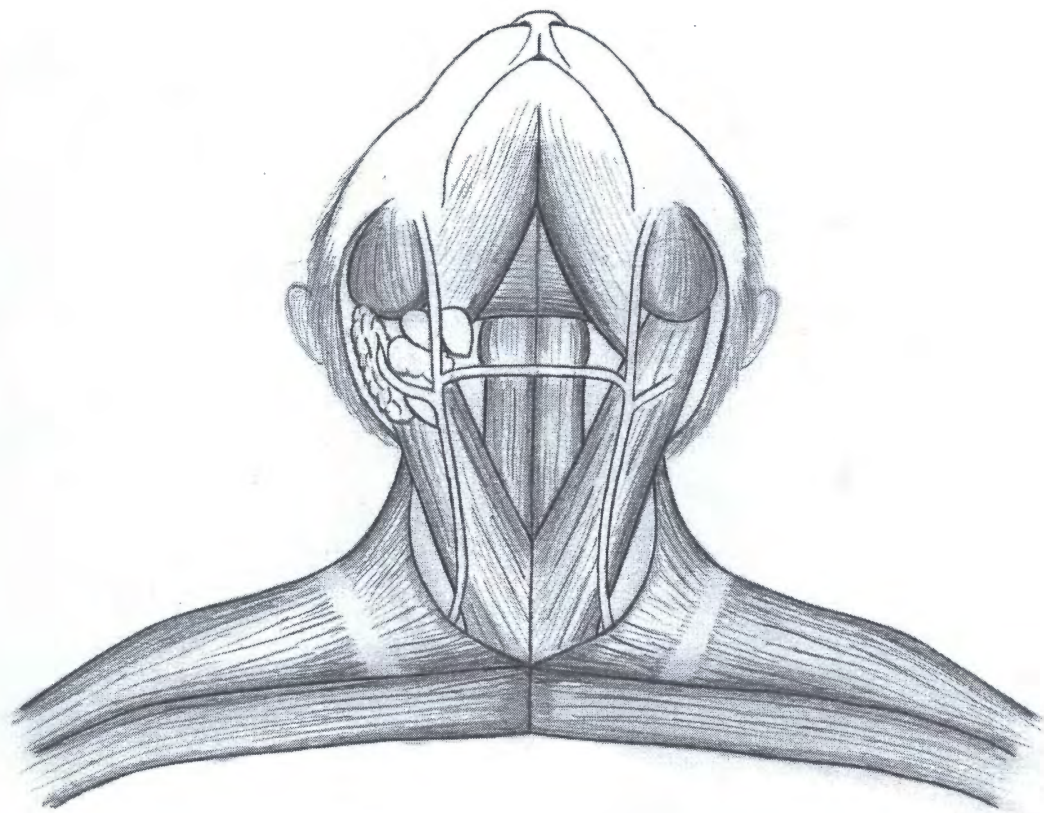


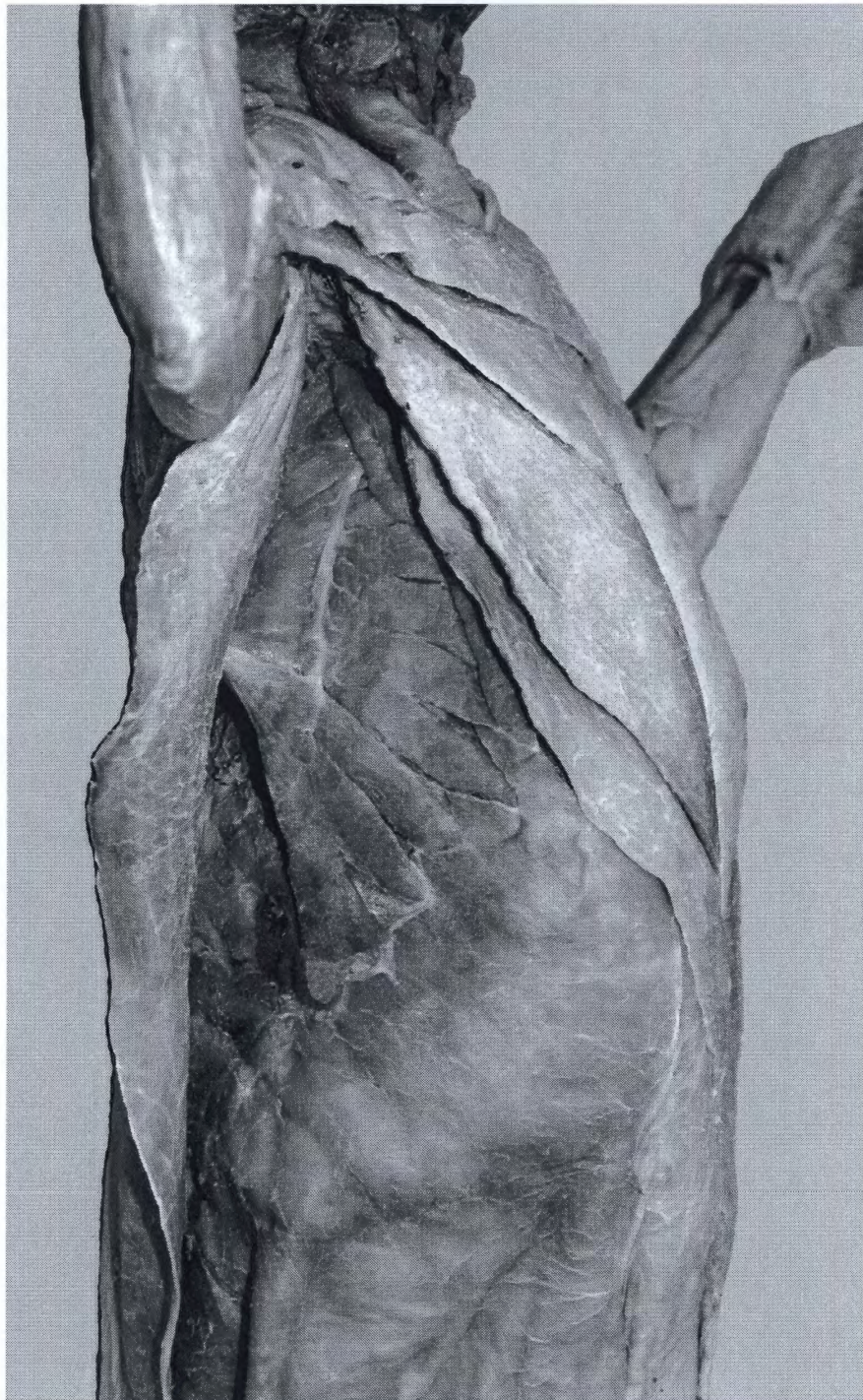
Ventral view of the chest (superficial)



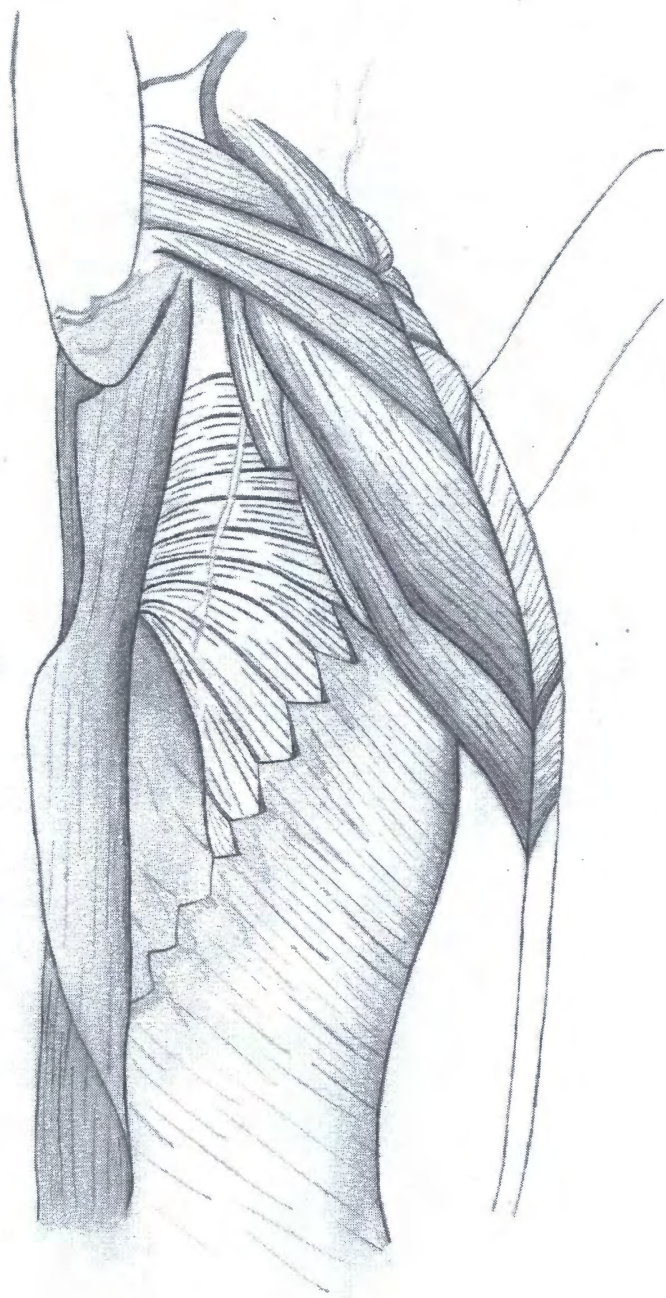


Ventral view of the throat (superficial)





Lateral view of the right side of the chest (superficial)



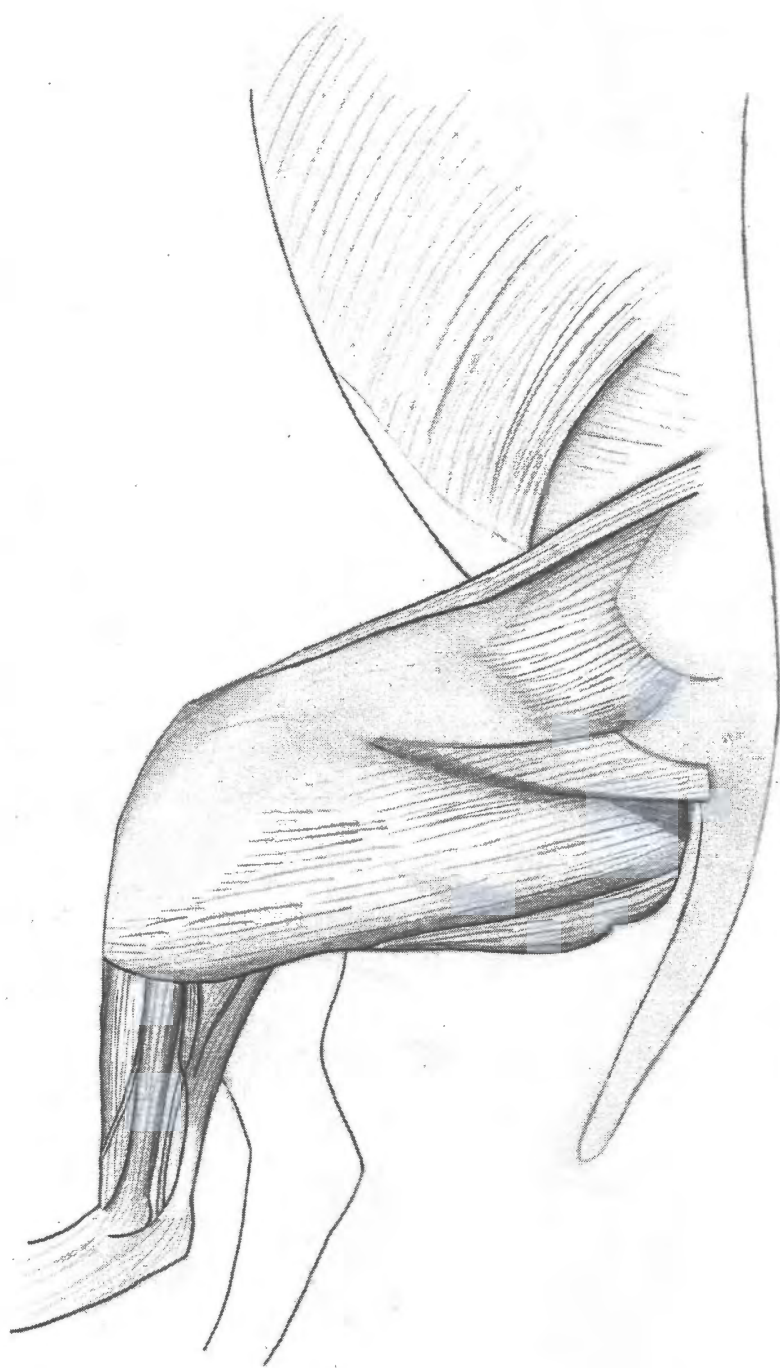


Lateral view of the left shoulder (superficial)





Lateral view of the left hip (superficial)



Additional Photographs of Dissection Process



